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# Fiscal Year 2016 Annual Energy Report



Prepared by the State Energy Manager's Office at the Department of Administrative Services with assistance from the Department of Environmental Services and the State Government Energy Committee.



## Summary of Report Findings

After two consecutive winters that were significantly colder than the average, FY2016's weather swung to the other extreme and delivered an abnormally warm and dry winter resulting in artificially-low energy consumption. Energy efficiency investments must be accelerated to meet the more ambitious fossil fuel reduction targets set by Governor Hassan's newly issued executive order. The State's energy saving performance contracting (ESPC) program is back in full swing with two projects wrapping up construction in FY2017 and another project beginning the investment-grade audit phase. ESPC is a crucial investment tool for meeting the new executive order reduction goals. The State is also pursuing the use of renewable fuels like biodiesel to heat some of its buildings as another way to reduce fossil fuel use and increase the use of local energy sources.

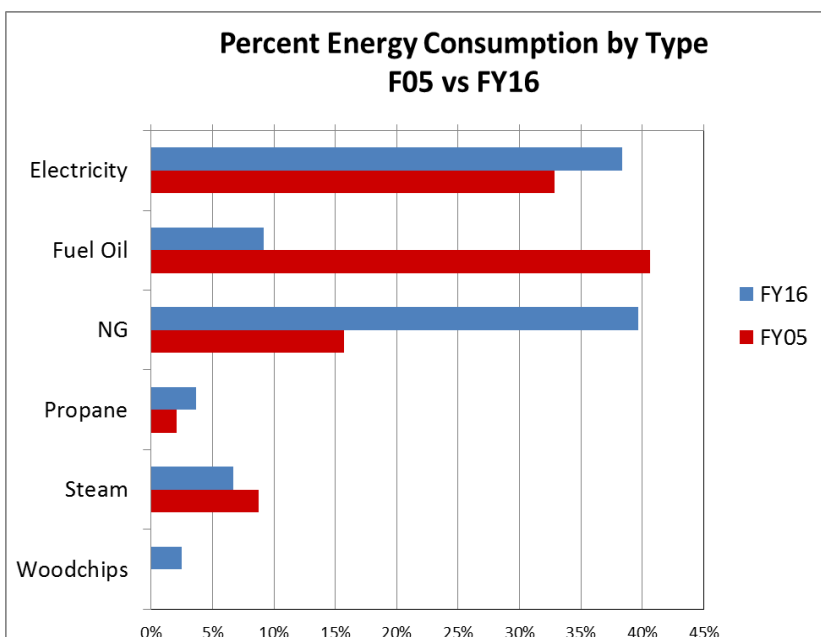
### Highlights

- Executive Order 2016-03 signed by Governor Hassan bolsters NH government energy efficiency goals and building-performance design standards.
- Regional nuclear power plant closings will likely increase the use of fossil fuel generated power in NH.
- 2016 was the warmest winter in recorded history, both in NH and globally and had significant affects on energy use.

## Overview of the State of New Hampshire's Energy Use

New Hampshire state government uses energy to provide electricity and heat to its buildings and to power its vehicle fleet. The State owns and operates more than 500 buildings and occupies many more in the form of leased space. The State's energy portfolio has changed significantly since FY2005. This change is illustrated in *Figure 1*, below, by detailing energy consumption by type and comparing the baseline year FY2005 to the current year FY2016. In addition to buildings, the State operates a passenger vehicle fleet of approximately 2,300 vehicles.

**Figure 1 - Energy Consumption by type**



New Hampshire state government has been successful in significantly reducing the amount of energy used to power its lights and appliances, heat its buildings, and operate its vehicles since it began tracking this information in FY2005. During this same time period, energy prices for transportation fuels, heating oil, propane, and electricity all increased significantly. However, energy efficiency investments and fuel-switching projects implemented since FY2005 have provided the State with over \$10.5 million in avoided energy costs. As the State's energy supply is largely derived from fossil fuels which are sourced from outside of NH bor-

ders, these savings represent dollars that were retained within the state's economy and represent a monetary savings to New Hampshire's tax payers.

In FY2016, the State's fossil fuel reduction targets were bolstered by the newly issued Executive Order (EO) 2016-3. Governor Maggie Hassan set a three-tiered goal of reducing fossil-fuel use in state facilities by 30, 40, and 50 percent as compared to FY2005 levels by 2020, 2025, and 2030 respectively. Reductions are to be measured on a square-foot basis in accordance with RSA 21-I:14-c. The order also requires agencies to comply with a Clean Fleet Program as established by the State Government Energy Committee (SGEC, formally established in EO 2016-03) to improve the operation and overall fuel economy of the state vehicle fleet.

### New Hampshire State Government Building Energy Use

The State tracks its building-energy use in two ways, *total energy use* and *fossil fuel energy use*. Total energy use is the sum of all thermal and electrical energy consumption and is measured in British Thermal Units (Btus), which provide the ability to compare the energy use intensity of individual buildings regardless of their fuel type. Fossil fuel energy use is defined as thermal and electrical power consumed that is generated through the burning of fossil fuels such as, but not limited to, propane, oil, diesel, natural gas and coal. Fossil fuel energy use is reported as a percentage of the state's total energy consumption. Building-energy use is evaluated on an Energy Use Intensity (EUI) basis by calculating the Btus used per square foot of building space.

As summarized in *Table 1* below, between FY2005 and FY2016, the square footage of building space owned by state government increased by twelve percent while overall energy use decreased by nine percent and the amount of energy derived from fossil fuels also decreased by nine percent. This equates to a reduction in EUI of nearly 21 percent and a reduction in fossil-fuel EUI by nearly 20 percent. Energy costs are significantly higher than they were in FY2005 resulting in a 22 percent increase in energy costs, even as energy usage has dropped.

**Table 1 - Summary of State of NH Energy Consumption (FY05 & FY16)**

	Total Square Feet	Total kBTus Used	Fossil-Fuel kBTus Used	Total Cost	Cost Use	EUI	FF EUI
					(\$ per sq ft)	(kBTus per sq ft)	(fossil fuel kBTus per sq ft)
FY05	6,890,482	895,640,814	660,171,441	\$15,092,715	\$2.02	124.7	92.6
FY16	7,726,787	813,559,037	599,446,344	\$18,441,950	\$2.16	98.9	74.4
% Change	12%	-9%	-9%	22%	7%	-21%	-20%

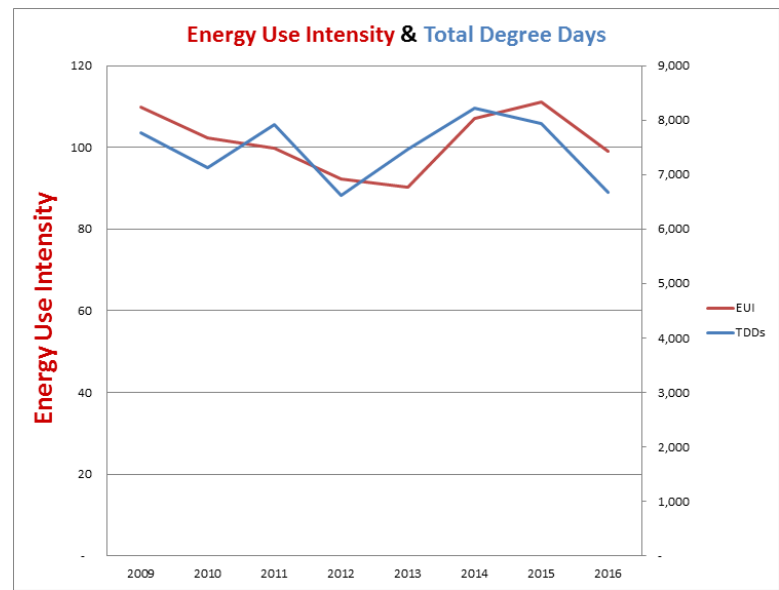
Weather has a profound effect on energy use and this is especially true for state buildings. For this reason, we must consider weather in our energy calculations to determine if a perceived reduction or increase in energy use from one year to the next is the result of energy efficiency or if it because of weather variations. The metrics we use to measure weather's impact on energy usage are called heating degree days (HDD) and cooling degree days (CDD). Heating degree days are the number of degrees Fahrenheit that a day's *average* temperature is below 65° F and cooling degree days are

the number of degrees F the average daily temp is above 65°F (e.g. a day with average temp of 50°F would have 15 HDD). A winter with more heating degree days means that there was higher heating demand for buildings and thus more energy required. Similarly, more cooling degree days in the summer means those buildings with air conditioning would have higher cooling demand therefore requiring more energy.

Fiscal years 2014 through 2016 show a clear example of how weather conditions in NH affected energy performance in state-owned buildings. FY2014 and FY2015 were among the coldest winters in New Hampshire records, then FY2016 provided the opposite with the warmest year on record both globally and in NH. The relationship between total degree days (HDD + CDD) and energy intensity of state buildings (EUI) is clearly illustrated in *Figure 2*. This figure shows increased energy usage during the extreme cold of FY2014 and FY2015 then a sharp decrease of EUI in FY2016 mirroring the dramatic decline in total degree days (TDD) that year.

Understanding the significant impact that degree days (especially heating degree days) have on building energy use, priorities must be placed on investments in high efficiency heating systems and weatherizing state buildings. Projects that focus on air-sealing and insulation will not only save energy but lead to lower energy costs and increased comfort for the occupants of the State’s buildings.

**Figure 2 - Degree Days vs. EUI**



Had the State not pursued energy efficiency and fuel-switching opportunities aggressively over the past ten years, the State’s energy expenditures would have been much higher. Based on an analysis of state energy consumption and cost expenditure data, the State’s energy management efforts since 2005 are estimated to have avoided over \$10.5 million through FY2016.

**Energy-Use Tracking Methodology**

Adjustments were made to the method used to calculate total fossil fuel use for the baseline (FY2005) through the current year. The electricity that the state consumes from nuclear sources has now been included as a *non-fossil fuel* energy source. In the past, the non-fossil fuel energy sources for the electric sector only included renewable energy sources. Nuclear energy was improperly categorized as a fossil fuel. The immediate result of this correction is an apparent 19 percent reduction of fossil fuel usage in our baseline year. The accounting change has been applied to all years including baseline and current FY2016, at this time the effect on our targets is very small. However, in the coming years these calculations will reflect a greater impact on the State’s fossil fuel reduction progress as regional nuclear plants begin to close<sup>1</sup> and more of our electric grid power will

<sup>1</sup> Vermont Yankee closed in FY15 and Pilgram in MA is slated to close in FY19.

come from fossil fuel sources. As such, the State will need to work harder to meet its fossil fuel reduction goals.

### **What's New in Executive Order 2016-3?**

Since 2011, the State has been working towards reducing its fossil fuel use in state buildings. This change, from an absolute energy reduction goal, has been working well for the State, as it not only encourages energy reductions, but also the replacement of energy types with non-fossil fuel sources. The State had been getting closer and closer each year, nearly meeting the 25 percent reduction goal set in 2011. With strong progress being made and the region collectively reaching toward more stringent goals, Governor Hassan issued a 3-tier goal requiring state agencies to increase their reduction efforts. The State as a whole is now striving toward reducing fossil fuel use per square foot by 30 percent by 2020, 40 percent by 2025, and 50 percent by 2030. All of these targets are as compared to the original FY2005 baseline.

The executive order also strengthens the building energy performance standards that state capital projects must meet. Large projects (over one million dollars and affecting more than 25,000 square feet) are still required to meet a high-performance design standard, but starting in 2017, a second tier standard will apply efficiency requirements on smaller projects as well. All new construction projects are still required to consider implementing renewable energy when cost effective.

Other notable changes include how the state measures and reports on progress toward reduction goals by accounting for normal variation in weather and energy use. State energy staff will consider average energy-data over a three-year period and also normalize data for weather to more accurately depict actual progress being made. Additionally, performance based standards will be used to categorize state facilities by type/usage and then compare their performance to each other and against a national average. Buildings that fall too far outside an acceptable energy performance range will be targeted for efficiency improvements.

### **The Volume of Work to be Done**

With more ambitious energy savings targets in place, the State has even more work to do than in years past. The State Energy Management Office (SEM) within the Department of Administrative Services (DAS) has grown from a sole State Energy Manager in 2005 to a team of two and a half employees, adding an energy project manager in 2009 and a part-time data analyst in 2015. There are massive opportunities state-wide for reducing ongoing operating expenses through investments in energy efficiency. However, without adequate investments of additional capital and personnel resources, the State is unlikely to achieve these energy reduction goals and their associated cost savings.

Ultimately, it is each agency's responsibility to meet these reduction targets and SEM will continue to provide as much technical and financial support as possible to aide in their success. Each agency is required to appoint an Energy Coordinator to help organize and implement their energy efficien-

cy efforts and who will interface with SEM. Executive Order 2016-03 better defines the role and duties of Energy Coordinator. The SEM has taken time to meet with Energy Coordinators individually and as a group to provide them with energy reduction strategies to use within their agencies.

Additionally, the State Energy Manager has analyzed the performance of past energy efficiency capital investments and energy saving performance contracts to project the level of investment required to meet energy reduction goals moving forward. With the expected fossil fuel reductions associated with these investments, it is estimated that the State will need to infuse a minimum of \$40 million into energy efficiency projects over the next 13 years to meet the current reduction targets set by the Executive Order.

## **Fleet Info**

Since FY2009, the state passenger auto and medium and heavy duty truck fleets have reduced mileage by over 11 percent, or approximately 3.4 million vehicle-miles travelled (VMT), as shown in *Table 2* below. Of this, the passenger automobile fleet was responsible for a 2.1 million VMT reduction, which translates to a 15 percent decrease in that fleet sector.

The fuel economy of the passenger vehicle fleet, also referred to as miles per gallon (MPG), has remained relatively steady from FY2009 to today. Had the State been able to improve overall fuel economy of the fleet vehicles, a significant challenge due to budget constraints, the State's transportation energy costs could have been even lower. The SGEC continues to ramp up minimum fuel economy requirements for new fleet purchases, while remaining cognizant of vehicle availability and cost. It is anticipated that the increasing federal fuel economy standards will improve availability of highly efficient vehicles that are cost-effective in the coming years.

**Table 2 - Fleet Annual Energy Report by vehicle type**

	Number of Vehicles		Annual Miles		Annual Fuel (gal)	
	2009*	2016	2009*	2016	2009*	2016
Passenger Automobiles	965	849	14,304,221	12,140,735	747,191	640,018
Light Duty Trucks (≤8,500 lbs.)	579	567	7,870,055	7,156,217	500,847	433,830
Light Duty Trucks (8,501 to 10,000 lbs.)	345	351	5,551,098	5,172,889	431,387	421,265
Medium Duty Trucks (10,001 lbs. to 14,000 lbs.)	62	70	442,817	609,870	46,615	57,885
Heavy Duty Trucks (>14,000 lbs.)	483	469	1,232,502	870,873	890,008	785,087
State Total	2,434	2,306	29,400,693	25,950,584	2,616,048	2,338,085

\*Number of vehicles for 2016 includes surplus vehicles, which, when subtracted from the total, bring the number of vehicles active in FY2016 to a number comparable to the FY2009 fleet total. The data for FY2009 does not include any energy utilization by vehicles surplussed prior to the end of FY2009.

While MPGs have remained steady, the significant decrease in VMT has reduced our total fuel usage by almost 11 percent. This reduction in fuel usage has allowed the state to reduce its fleet-produced greenhouse gas (GHG) emissions by approximately 19 percent. The largest fleet sectors (passenger automobiles and light duty trucks) have been able to reduce the GHG emissions by approximately 11 percent since FY2009. Starting in FY2017 we will be tracking this data against a FY2010 baseline level since the FY2009 data is missing vehicles that were surplus during the year. In FY2010 we started tracking all energy output in a fiscal year, regardless of the date of surplus.

As with prior years, the State is encouraging the use of conference calls and online meetings to replace face-to-face meetings when possible. Using these technical resources, when appropriate, can save vehicle fuel energy by reducing VMT.

### **Looking Toward the Future**

The State must develop and embrace a multi-pronged strategy to achieve the fossil fuel reduction targets outlined in Executive Order 2016-03. Achieving these energy reduction goals generates a multitude of additional benefits for the State. Energy costs for State government will be reduced and a divestiture in fossil fuels will provide insulation against the uncertainty of fossil fuel pricing fluctuations. More investment in in-state energy sources will support local jobs and bolster the local economy by returning tax payer money back into local markets.

Strategies that the State can utilize to meet reduction goals include the purchase of renewable energy through statewide contracts, converting to non-fossil heating sources such as biodiesel and biomass, and completing energy conservation projects by means of capital investments and energy saving performance contracts. No single strategy will be able to attain the goal by itself.

It is projected that the State will need to invest a minimum of \$40 million over the next 13 years to achieve the 50 percent reduction target indicated for the year 2030.

DAS Energy Management Office intends to continue implementing ESPCs which serve as effective tools in pursuing state-wide energy reduction goals. At current staffing levels, the department is able to issue one request for proposals (RFP) per year on average. With the potential for significant energy and dollar savings, it may make sense for the State to dedicate more resources to this effort.

In department-level energy conservation plans, state agencies identified over \$25 million in potential energy-saving projects. If agencies had expanded access to energy audits, retro-commissioning, energy saving performance contracts, and other tools to gather information about their buildings, significantly more cost-saving measures would be uncovered. At the current rate of addressing these energy inefficiencies, the State is leaving valuable savings on the table. The State is in need of more resources including staff, funding, and education to ensure that all cost-effective energy efficiency measures are implemented in a timely manner.



**Table 3 - State Annual Energy Report FY2016**

Annual Energy Report										
Baseline FISCAL YEAR 2005 Versus Last-4-Quarters ending 06/30/2016										
Energy Use, Intensity, and Costs Summary										
Department	Area (Square Footage)		Total kWh			EUI (Energy Per Square Foot)			Total Cost	
	FISCAL YEAR 2005	06/30/2016	FISCAL YEAR 2005	06/30/2016	% Change	FISCAL YEAR 2005	06/30/2016	% Change	FISCAL YEAR 2005	06/30/2016
Corrections	959,275	740,422	221,827,306	165,062,195	-26%	231	223	-4%	\$2,542,059	\$2,589,540
Health and Human Services	583,353	591,015	127,488,331	117,475,946	-8%	219	199	-9%	\$1,577,526	\$1,708,487
Juvenile Justice Services	102,542	187,752	35,676,835	43,943,356	23%	348	234	-33%	\$311,796	\$629,560
NH Hospital	314,471	211,713	64,502,714	38,342,018	-41%	205	181	-12%	\$1,052,875	\$755,475
Glenciff Home	162,035	172,029	26,832,476	35,190,211	31%	166	205	24%	\$202,979	\$323,080
HHS	0	19,521	0	362	N/A	N/A	0	N/A	\$0	\$371
Behavioral Health	4,305	0	476,306	0	-100%	111	N/A	N/A	\$9,876	\$0
NH Veterans Home	172,600	196,565	21,070,445	23,065,600	9%	122	117	-4%	\$400,689	\$466,396
Administrative Services	2,584,971	3,177,789	265,878,418	284,899,877	7%	103	90	-13%	\$5,580,568	\$7,879,235
Police Standards & Training	57,100	57,100	4,548,100	5,098,694	12%	80	89	12%	\$54,578	\$65,398
Fish & Game Commission	189,281	158,040	14,560,401	11,916,420	-18%	77	75	-2%	\$294,030	\$301,734
DOT	677,287	727,813	82,836,806	50,936,565	-39%	122	70	-43%	\$1,391,310	\$1,031,744
Employment Security	150,448	199,948	16,647,383	13,046,387	-22%	111	65	-41%	\$368,240	\$358,438
Liquor Commission	181,559	197,432	14,217,778	12,931,861	-9%	78	66	-16%	\$293,732	\$374,191
DRED	269,281	367,104	22,551,981	22,108,015	-2%	84	60	-28%	\$358,894	\$685,368
Cannon Mountain <sup>1</sup>			22,896,097	37,841,307	65%				\$712,733	\$1,315,577
Dept of Safety	245,611	258,772	18,705,833	14,969,438	-20%	76	58	-24%	\$381,387	\$363,235
Environmental Services	15,419	15,759	1,277,019	890,039	-30%	83	56	-32%	\$31,702	\$31,359
Wastewater Treatment Operation <sup>2</sup>			13,566,494	11,295,999	-17%				\$433,321	\$411,875
Adjutant General	772,580	1,007,311	47,508,099	41,951,407	-12%	61	42	-32%	\$670,946	\$855,696
Dept of Agriculture	31,717	31,717	60,323	69,285	15%	2	2	15%	\$999	\$3,678
	6,890,482	7,726,787	895,640,814	813,559,037	-9%	125	99	-21%	\$15,092,714	\$18,441,950

1 - Wastewater Treatment Operations are listed as part of the Department of Environmental Services, but its energy is not measured on a per-square-foot basis due to the uniqueness of the usage profile.  
Does not include Propane and Fuel Oil cost and consumption.

2 - Cannon Mountain is listed as part of the Department of Resources and Economic Development, but its energy is not measured on a per-square-foot basis due to the uniqueness of the usage profile.



# Table 4 - Fleet Annual Energy Report

## Passenger Automobiles

Agency Name	Number of Vehicles		Annual Miles		Annual Fuel (gal)		Annual MPG		CO2 (Metric Tons)	
	2009*	2016	2009*	2016	2009*	2016	2009*	2016	2009*	2016
DOT	120	111	1,888,904	1,171,094	67,002	42,594	28.19	27.49	537	342
DRED	22	15	251,014	190,018	9,248	6,520	27.14	29.14	74	52
Fish & Game	8	4	98,561	13,459	3,810	437	25.87	30.80	31	4
Safety***	494	443	7,862,327	7,565,258	497,667	462,204	15.80	16.37	3,991	3,707
Other	321	276	4,203,415	3,200,906	169,464	128,263	24.80	24.96	1,359	1,029
<b>State Total</b>	<b>965</b>	<b>849</b>	<b>14,304,221</b>	<b>12,140,735</b>	<b>747,191</b>	<b>640,018</b>	<b>19.14</b>	<b>18.97</b>	<b>5,992</b>	<b>5,133</b>

## Light Duty Trucks 1 (pickup trucks, vans, minivans and SUVs up to 8,500 lbs)

Agency Name	Number of Vehicles		Annual Miles		Annual Fuel (gal)		Annual MPG		CO2 (Metric Tons)	
	2009*	2016	2009*	2016	2009*	2016	2009*	2016	2009*	2016
DOT	122	103	1,849,714	1,635,290	113,737	97,346	16.26	16.80	912	781
DRED	80	88	827,977	755,844	52,776	44,802	15.69	16.87	423	359
Fish & Game	83	63	1,371,476	833,472	92,761	54,029	14.79	15.43	744	433
Safety***	117	141	1,561,591	1,906,545	99,832	115,520	15.64	16.50	801	926
Other	177	172	2,259,297	2,025,066	141,741	122,133	15.94	16.58	1,137	980
<b>State Total</b>	<b>579</b>	<b>567</b>	<b>7,870,055</b>	<b>7,156,217</b>	<b>500,847</b>	<b>433,830</b>	<b>15.71</b>	<b>16.50</b>	<b>4,017</b>	<b>3,479</b>

## Light Duty Trucks 2 (pickup trucks, vans, minivans and SUVs from 8,501 lbs to 10,000 lbs)

Agency Name	Number of Vehicles		Annual Miles		Annual Fuel (gal)		Annual MPG		CO2 (Metric Tons)	
	2009*	2016	2009*	2016	2009*	2016	2009*	2016	2009*	2016
DOT	193	179	4,328,381	3,399,323	331,143	283,587	13.07	11.99	2,656	2,274
DRED	50	48	325,354	390,633	29,813	32,442	10.91	12.04	239	260
Fish & Game	15	32	91,534	521,119	6,533	40,837	14.01	12.76	52	328
Safety***	16	29	145,840	319,218	11,718	25,330	12.45	12.60	94	203
Other	71	63	659,989	542,596	52,180	39,069	12.65	13.89	418	313
<b>State Total</b>	<b>345</b>	<b>351</b>	<b>5,551,098</b>	<b>5,172,889</b>	<b>431,387</b>	<b>421,265</b>	<b>12.87</b>	<b>12.28</b>	<b>3,460</b>	<b>3,379</b>

## Medium Duty Trucks (pickup trucks, vans, minivans and SUVs from 10,001 lbs to 14,000 lbs) [fuel assumed to be diesel]

Agency Name	Number of Vehicles		Annual Miles		Annual Fuel (gal)		Annual MPG		CO2 (Metric Tons)	
	2009*	2016	2009*	2016	2009*	2016	2009*	2016	2009*	2016
DOT	16	21	210,015	369,503	16,910	30,996	12.42	11.92	172	315
DRED	13	14	68,589	107,836	7,326	11,350	9.36	9.50	74	115
Fish & Game	2	1	8,211	645	1,092	154	7.52	4.19	11	2
Safety***	1	6	5,853	26,551	580	2,428	10.09	10.94	6	25
Other	30	28	150,149	105,335	20,707	12,957	7.25	8.13	210	132
<b>State Total</b>	<b>62</b>	<b>70</b>	<b>442,817</b>	<b>609,870</b>	<b>46,615</b>	<b>57,885</b>	<b>9.50</b>	<b>10.54</b>	<b>473</b>	<b>588</b>

## Trucks Greater than 14,000 lbs [fuel assumed to be diesel]

Agency Name	Number of Vehicles		Annual Miles		Annual Fuel (gal)		Annual MPG		CO2 (Metric Tons)	
	2009*	2016	2009*	2016	2009*	2016	2009*	2016	2009*	2016
DOT	415	401	947,714	598,946	853,347	718,102	1.11	0.83	9,619	6,079
DRED	11	9	46,455	41,887	6,416	5,692	7.24	7.36	472	425
Fish & Game	19	17	94,240	64,850	10,316	7,169	9.14	9.05	957	658
Safety***	15	14	31,234	37,199	4,342	4,569	7.19	8.14	317	378
Other	23	28	112,859	127,991	15,587	49,555	7.24	2.58	1,146	1,299
									0	0
<b>State Total</b>	<b>483</b>	<b>469</b>	<b>1,232,502</b>	<b>870,873</b>	<b>890,008</b>	<b>785,087</b>	<b>1.38</b>	<b>1.11</b>	<b>12,510</b>	<b>8,839</b>

\*Number of Vehicles for 2016 includes surplus vehicles, which when subtracted from the total, bring the number of vehicles active in FY2016 to a number comparable to the FY2009 fleet total. The data for 2009 does not include any energy utilization by vehicles surplussed prior to the

\*\*Fleet data was compiled by the Fleet Management Administrator at the Department of Administrative Services from reports provided by each agency or department owning one or more vehicles (excluding Component Units).

\*\*\*Safety and State Police data have been combined for FY2016 due to new reporting system. We are working on interfacing directly with Safety's internal reporting system so we will be able to break out State Police in FY2017 and moving forward.